ELSEVIER

Economic Modelling 20 (2002) 119–139

Economic Modelling

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Imperfect competition in computable general equilibrium models — a primer

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Accepted 18 July 2001

Abstract

Economists normally view the field of imperfect competition in general equilibrium as an open Pandora's box of theoretical and practical problems. For example, how should the oligopoly markup be calculated in models where producers sell some faction of their output to multiple purchasers, which often is the case in applied models based on an input/output structure? How do we calculate the general equilibrium elasticities of demand? Is the choice of numéraire important for the results? Many economists introduce imperfect competition in their applied models with a simple markup based on a Marshallian approximation of demand ignoring these problems. This may result in mis-specified models and possible wrong results. We seek to provide practical solutions to the three problems.

JEL classifications: C68; D43

Keywords: Imperfect competition; Computable general equilibrium models; Cournot competition

1. Introduction

Economists normally view the field of imperfect competition in general equilibrium models as an open Pandora's box of theoretical problems, but an increasing

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0264-9993/02/$ - see front matter
PII: S0264-9993(01)00088-8

number of policy questions require that we incorporate imperfect competition in our models. Multinational firms, for example, cannot be analyzed in a model with perfect competition, as the multinationals are associated with increasing returns to scale created by knowledge-based assets (Markusen, 1998). Competition policy is another issue that the traditional models with perfect competition cannot analyze.

The main theoretical problems in models with imperfect competition relate to how the optimal markup should be determined. They can be summarized as follows: what is the optimal markup when we have more than one buyer, and the buyers have different elasticities of demand? How do we calculate the elasticities of demand in a general equilibrium model? Is the choice of numéraire important for the results?

Many economists introduce imperfect competition in their computable general equilibrium models (CGE) with a simple markup on marginal costs.[2] Most of these modelers ignore the third problem and get around the first two problems by using large group monopolistic competition where the scale of individual firms and the elasticity of demand are identical and fixed (see for example Gasiorek et al., 1992). Another way of getting around the two first problems is to assume isoelastic demand and linear cost functions, which also results in fixed and well-defined markups (see for example Cox and Harris, 1985). Finally some ignore all of the problems and simply use the final consumer's elasticity of demand in their markups (see for example Harrison et al., 1997). However, the large group assumption and isoelastic demand do not readily apply to all industries and consumers. We need practical solutions to the three problems within the more general Cournot competition to be able to meet the increasing demand for CGE models with imperfect competition. We offer several such solutions in this paper.

The first problem is a matter of heterogeneous demand. Many CGE models are based on an input/output structure with several buyers of the same good. Different buyers may have different elasticities of demand, and the producer needs to allow for this to maximize profits. The solution is simple if the producer can price discriminate among all the buyers, but this is often not so. Section 3 derives the optimal markup for a producer with different buyers.

The second problem relates to the difference between the Marshallian elasticity of demand and the general equilibrium elasticity of demand.[3] Most modelers use the Marshallian elasticity of demand to calculate the optimal markup and consequently ignore that changes in a price of an input affect the quantity of the output sold and as a result affects demand for the input. The general equilibrium elasticities of demand capture these effects. Section 4 shows how to derive an analytical expression for the general equilibrium elasticities of demand in models with Leontief production functions.[4] The section also provides a numerical method,

[2] For example, Cox and Harris (1985), Gasiorek et al. (1992), Harrison et al. (1996, 1997), and Francois and Roland-Holst (1996).

[3] Marshallian elasticities are also known as the uncompensated or gross elasticities.

[4] We have to ignore factor price effects in order to derive the analytical expression.